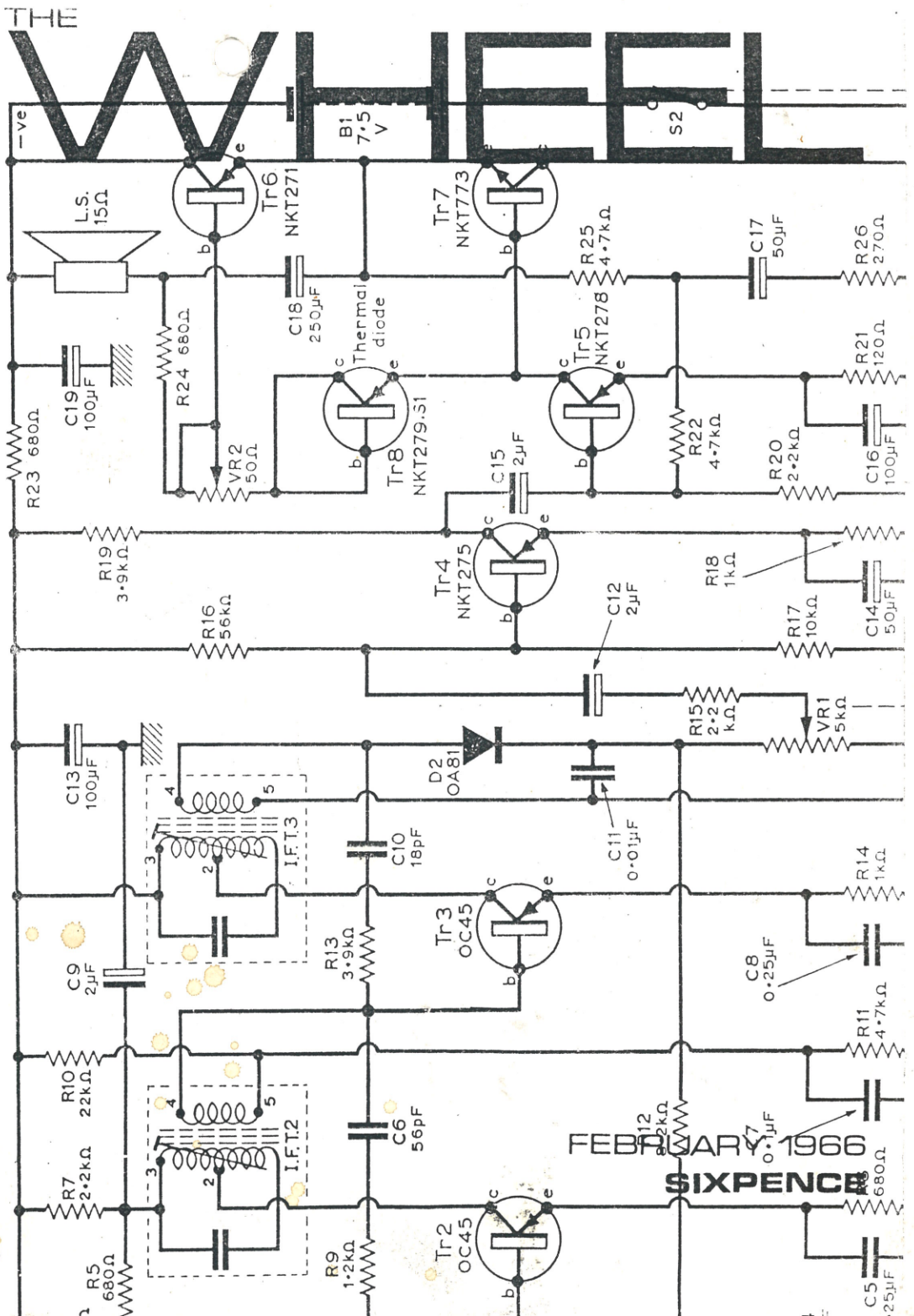
THE WHEEL



FEBRUARY 1966

SIXPENCE

THE WHEEL

The Magazine of the Engineering Faculty Society

Vol. 10. No. 1.

Published by the Engineering Faculty Society.

University of Southampton.

February 1966.

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Printed by Hurad Ltd., Christchurch.

COMMENT

R.L.NOBLETT

Engineers have to be inventive to survive. Part of this inventiveness is an analytical thought process. The undergraduate training must therefore embody the factual information of basic principles coupled with the development of this analytical thought process.

Having research workers lecturing on topics in their own field provides the best possible 'service' for supplying up-to-the-minute information. Unfortunately the analytical thought process does not necessarily follow. If the end product is facts then the means to this end is a good opportunity for developing this way of thinking.

At present the method of lecturing is that the lecturers notes are transcribed from his piece of paper to the blackboard and thence to the students piece of paper. This negates any thought effort by the student. He is so engrossed in copying the information correctly that he has no time to really think about the problem. The solutions to problems are given and solving further problems of the same type involves substituting different numbers in the derived formulae. The student is not called upon to derive the formulae for himself and therefore lacks a basic understanding of the adaption of the basic principles involved.

One way of introducing a way of thinking is by discussion and question/answer involvement of the class. Experience then teaches what type of questions give the right answers thus when the graduate has to solve a problem he knows what type of questions to ask himself. The process of teaching would be for the students to read the relevant chapter of a textbook and to spend the lecture time discussing how to solve a given problem with the information gleaned from the textbook. The question and answer procedure would keep the class awake and produce a greater intimacy and involvement with the subject.

The stumbling blocks to this ideal must lie with the lecturer and/or with the students. If the lecturer knows his subject fully and is human he should be able to cope with both the factful and facetious comments. The student must be able and want to read. The desire to read will be stimulated by

interest in the subject or an egotistical sense of 'one-upmanship' Some will not bother to read but will come to understand what is happening by the questions asked. The ensuing interest may stimulate some of the non - readers. Those non-readers who take no interest in the proceedings took the wrong turning after A-level and should get out.

The number of students being lectured limits the viability of this theory. Thirty students is possibly the maximum that this system could cater for. With larger numbers the lecturer would have to explain the work with reference to the textbook rather than do the work independent of same. The 'why' rather than 'what' principle being adopted.

The practical part of the course can be approached in the same way and indeed at the same time. Discussion would produce a theoretical piece of apparatus and the lecturer could then explain why the apparatus in the laboratory was chosen. Thus exposing the practical limitations for a viable design.

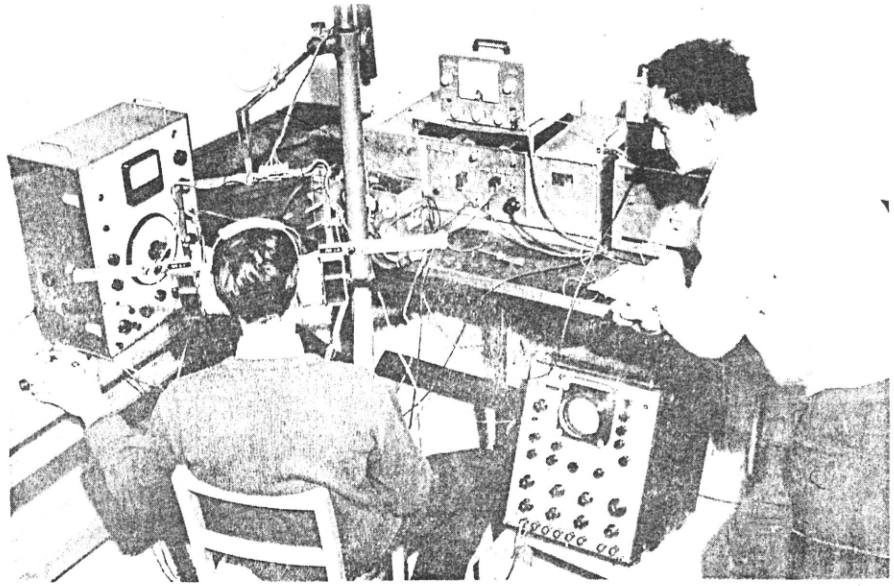
The problem then is one of delivering facts and at the same time developing an objective thought process and a sense of awareness. The solution is to read the facts from books and with discussion assimilate them into the required solution.

THE NOISE OF LIVING

G.J. MCNULTY

Many departments in the Engineering Faculty are not only engaged in research, but also undertake consultant work. This provides a wider scope of application of the research work. Useful industrial contacts can be established or maintained. The Institute of Sound and Vibration Research is no exception to this and some fifteen to twenty requests for advice have been received, nearly all of which have been concerned with alleviating a noise nuisance.

Until recently no criteria for noise assessment was established. However The Wilson Committee (1964) report on noise was published which laid down limitations to which a prima facie case of nuisance would be likely to occur. Never-

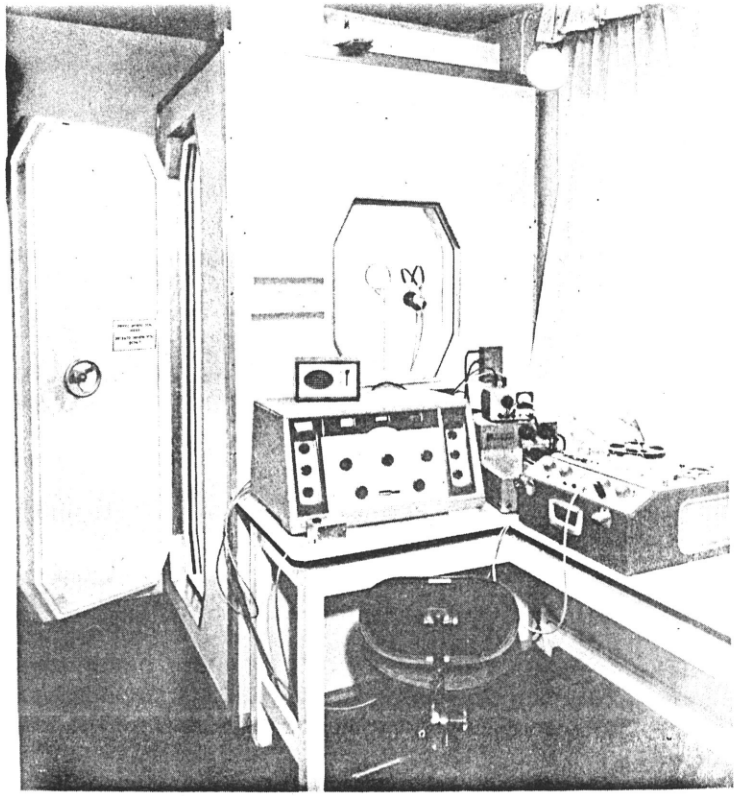


Earphone loudness evaluatiors of acoustic transients.

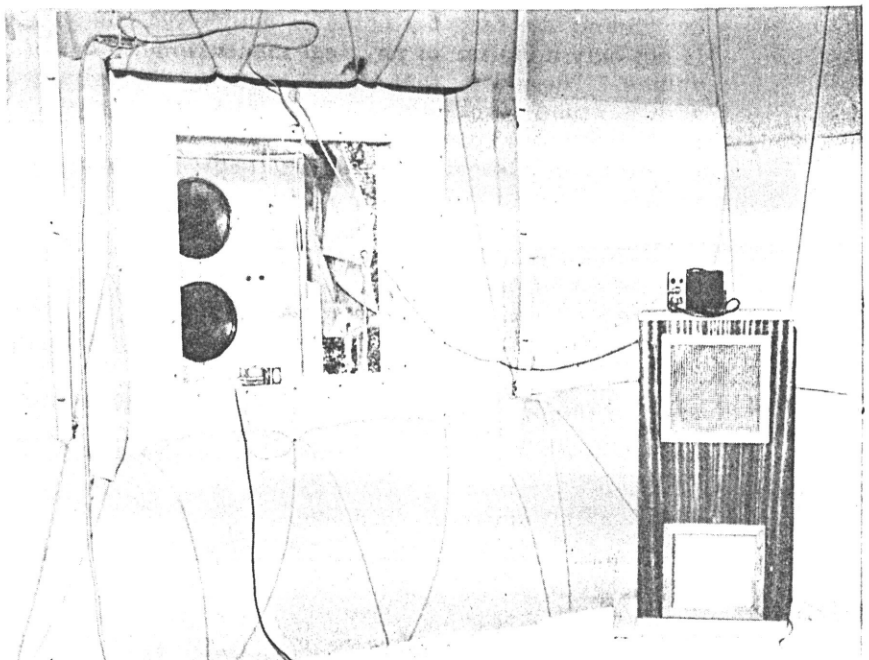
theless even when the noise is within the limitations laid down, and in some cases even below the Wilson figures, a court of law would consider other factors such as the reasonableness of the local community's opinion. Thus the Wilson figures however helpful are merely a guide to trends.

The questions may arise at this stage what is noise and how is it assessed? A general definition to the former would be "Sound which is undesired by the recipient". This brings out clearly the fact that noise is subjective and assessment is not only a matter of physical measurements but of human values. The unit of measurement is the decibel, measured with a sound level meter which must comply with certain specifications. To give some idea of what the readings mean in practice, below are the decibel readings of some familiar sounds.

Noise Source	Sound level Decibels
Quiet Room in Country	30
Men's Clothing Department in busy store.	50
Inside small car at 30 m.p.h.	70



Hearing testing equipment.



Women's Clothing Department in busy store.	Beyond range of instrument
Dough Dividing Machine	85
Heavy Farm Tractor at 2 ft.	92

The annoyance produced by a noise is often related to the information it conveys to the recipient or emotion it excites, rather than to its actual intensity; and one has to be engaged for some time in this type of work to realise how difficult it is to establish the area where the noise causes most disturbance. In two adjacent houses visited, one tenant complained bitterly of night noise set up by a local chemical factory, whereas the other tenant did not seem to be troubled. It is interesting to note that in the latter case the husband was earning useful overtime bonus at the factory concerned. The noise of a jet plane may be agony to some people, but to the mother waiting at the airport for her family the same aircraft would be like sweet music. A sound which most people would ignore in say the industrial part of a city, would be a disturbing noise in a quieter environment. Thus whether a sound is a noise or whether a noise is annoying may depend on many factors which are independent of its physical content.

When it has finally been established that a factory is causing a noise nuisance the next step is to make a detailed survey of the plant and machinery and hence to put forward recommendations. Another problem arises here as to what is actually causing the noise and it is often very difficult to pin the nuisance down to one simple source. In many cases screening is an answer, whereas in others exhaust pipes have to be redirected, a new cam has to be used or in a limited number of cases a complete assembly may have to be replaced by a quieter plant. The work from the initial complaint enquiry to the time when the recommendations have been carried out successfully may be from a few weeks to over a year.

As the standard of living increases life becomes noisier and the problem is with us for some time to come.

THE NEW BSC (ENG)

DR. R.E. STEPHEN

In October, 1964, the Engineering Faculty embarked upon a revised form of Part 1, the first year of the undergraduate course leading to the B. Sc. (Eng) degree. This is to be followed by revised syllabuses and new forms of degree structure for the remaining two years of the course.

Questions regarding various aspects of these changes have arisen in the minds of undergraduates. Some of these questions are discussed with Dr. R. E. Steven, President of the Engineering Faculty Society, who was Assistant Dean of the Faculty at the time of initiation of these new ideas.

Q. Do these changes mean that the older form of degree will have less value?

A. Emphatically no. A degree is not a medal which becomes tarnished with age. Nor does it become last year's model like an automobile. I would rather compare it to an apple tree. It will probably be some years before it bears fruit, but it will grow and flourish more or less depending on the climate and the nourishment it receives during its life. There are plenty of vigorous and gnarled specimens around who still produce fine blossoms and fruit, and indeed sprout new roots.

Q. What are the reasons for introducing these changes?

A. There are various reasons which were brought to a head by the recommendations of the Robbins' Report. First of all, it should be recognised that printed syllabuses are continually changing, if not in the printed word, certainly in the actual material lectured. Periodically they are re - worded to keep in step with the lecturers who are influenced by their own reading and research in their own subject. There is a very real reason for the Long Vacation and universities must be in the forefront of knowledge.

Sometimes barriers between departments collapse when it is realised that both are lecturing the same subject. A good example is Control, which originally became a subject as Servomechanisms, but has been recognised

as applying to all sorts of engineering processes. The basic principles are of fairly general application. New ideas come from research, from new staff and by contact of staff with industry and with other universities. Now and again a complete re-appraisal is valuable.

The second reason is the increase in student numbers implied by the Robbins' Committee. Means were sought to maintain a good measure of intimacy in staff-student relations and indeed to improve upon that existing at present. Development of supervisions and the project type of laboratory work are thought to be steps in the right direction.

At the Administrative level, economy of manpower and buildings must be kept in mind. Academically, standards must be maintained and continually improved whenever this is seen to be possible and desirable. Research and post-graduate courses are a necessary part of this process.

Q. Will the changes in syllabus detail mean a greater degree of specialisation?

A. No, not in the sense you mean. Greater emphasis will tend to be placed on fundamentals and common principles. Typical applications of principles will also be covered, but it is hoped to encourage greater flexibility and originality in a student's thinking. Again the project type of study and the discussion group are steps in the right direction.

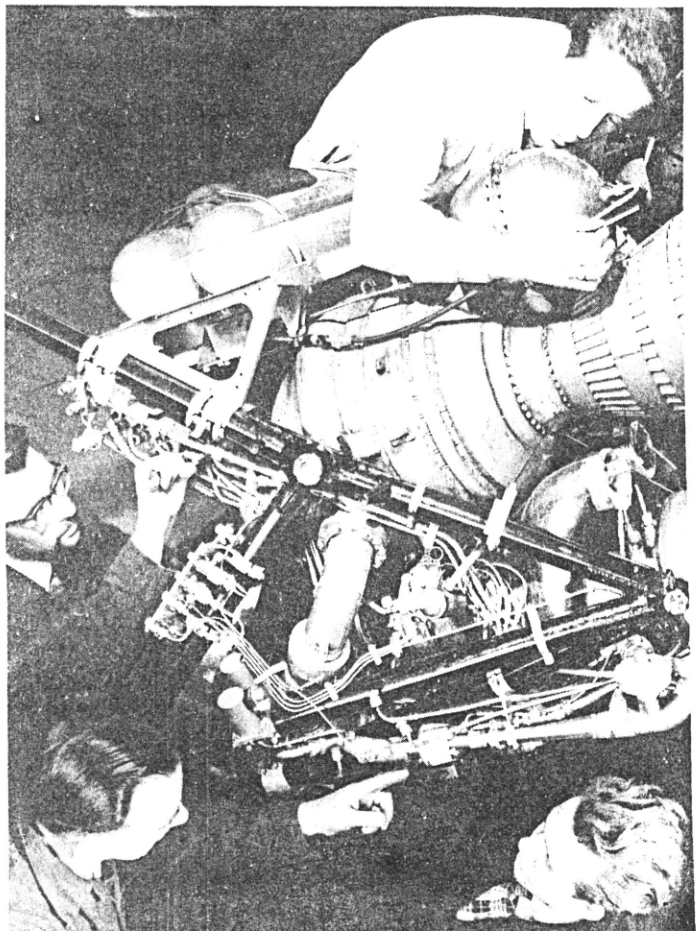
Inter-faculty studies are also being examined and the forms of undergraduate study available within the faculty are far from being narrowly constrained in a specialist sense.

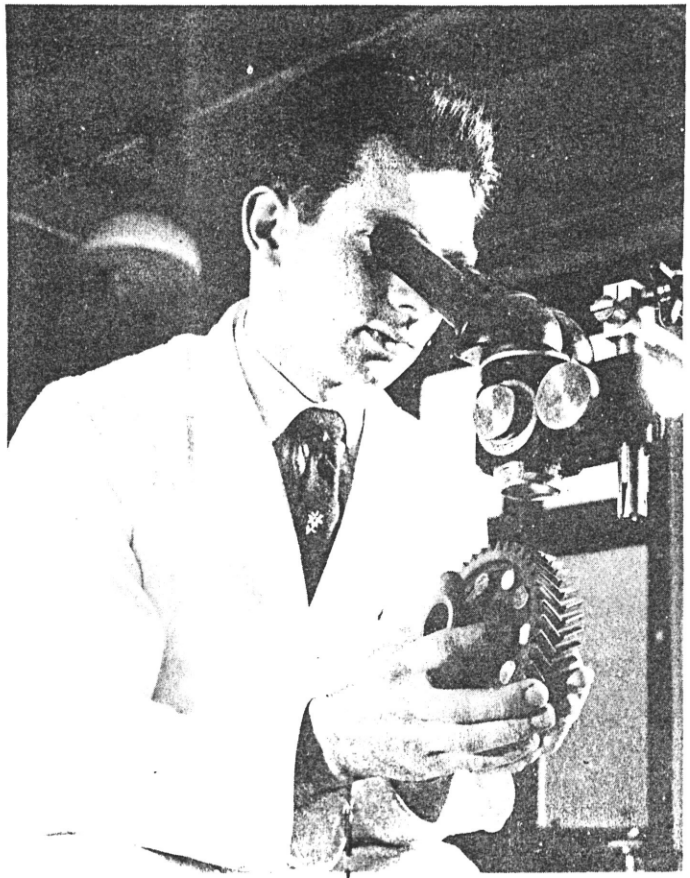
Q. It is understood that the course will be for an honours degree. Does this mean the end of the Ordinary degree and an attempt to put Southampton in the forefront in engineering degree standards?

A. The staff of any university worth its salt wants to produce the best possible graduate. We believe that we produce good honours graduates and we are simply saying so. We hope that our students will have the same ambition. But there will be those who do not quite make the grade, or who are better advised to embrace a lesser field of study. Adequate provision is made to ensure that they are properly catered for and there is provision for the award of an Ordinary degree in an honourable way.

THE AERONAUTICAL ENGINEER IN INDUSTRY

As part of their training, three engineering apprentices are being given instruction on the Bristol Siddeley Stentor rocket engine.





Such inspection work is part and parcel of a comprehensive yet flexible programme which the Company runs to cover current training requirements.

A Post-Graduate Apprentice assisting in the assembly of a 12 cylinder Bristol Siddeley M.D.655 diesel engine.

Compared to many other industries, the basic demands of aviation are pretty severe. The many thousands of parts that go to make a modern aircraft or its power unit have to be designed, developed and produced to the limits normally associated with watch making. This calls for the most exacting training.

BIRD IMPACT TESTING

R.A.BISHOP

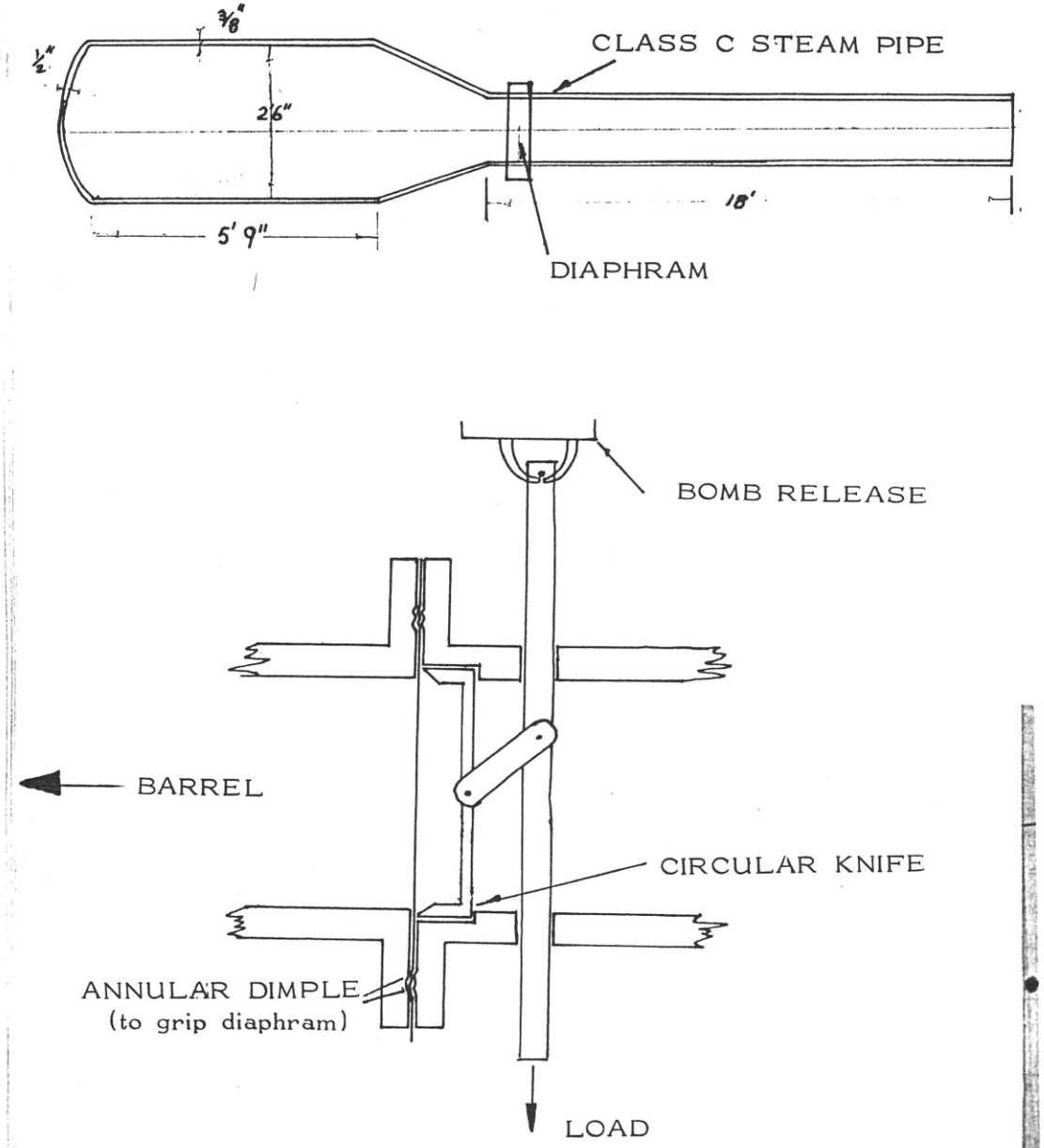
Specimens of modern aircraft are often tested to ascertain their resistance to damage caused by impact with birds.

The first problem of the test is to decide upon the size of bird to use. Aircraft often hit small birds, such as starlings but only rarely do they hit large ones such as swans or vultures, which may weigh up to 17lb. Therefore a bird of 4lb, has been decided upon as being a fairly representative compromise. Chickens were found to be of about this weight, and are readily available.

Having decided upon the bird to use the next problem is to decide upon the means of obtaining the correct relative velocity between the bird and the specimen. There are two ways of achieving this, either the bird can be fired at the specimen, or the specimen at the bird. Of the two methods the latter probably gives the more accurate results in that the bird is suspended in a much more realistic flight attitude, but in order to obtain the correct approach velocity a considerable length of expensive track upon which to mount the sled carrying the specimen, is necessary. This method is also very expensive in space consumed. For these reasons the first method is preferable.

The chicken is fired at the specimen from a gun consisting of a compression chamber with a length of commercial steam pipe as a barrel. The main disadvantage of this method is that the bird tends to hit the specimen in a solid lump. This is due to the fact that the bird must be wrapped in muslin in order to prevent the wings being ripped off in the barrel, the bird thus leaving the muzzle cleanly. The major difficulties encountered in this method are timing and finding a suitable cartridge case or plug. So far four ways of timing have been tried:

1) Two pairs of photoelectric cells.
2) Two wires perpendicular to the barrel.
3) Two light bulbs inserted in the barrel.
4) A high speed camera and checker board.



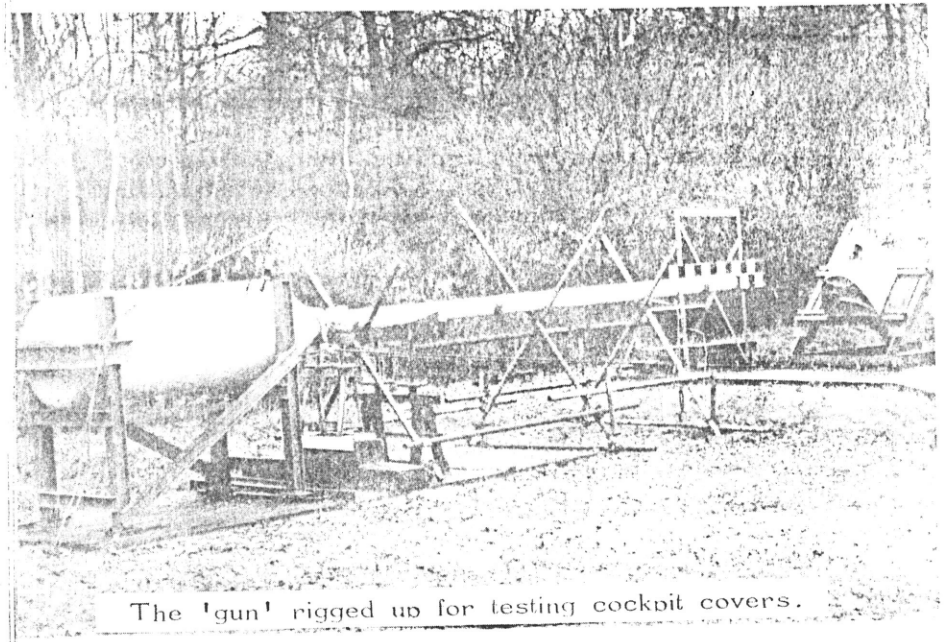
GENERAL ARRANGEMENT of GUN and BREACH BLOCK

Of the four methods the 'two wires' is possibly the best, because it is the one least affected by water vapour, or small pieces of muslin preceding the bird down the barrel. If the wires are of the correct breaking strain they will be undamaged by the muslin, but will be broken by the bird itself. Having set the wires at a known distance apart a simple circuit can be set up to record the time interval between the breaking of the first and second wires, thus giving the velocity of the bird directly. A similar circuit can be used with both the photoelectric cells and the light bulbs; however, both of these methods were found to be affected by things other than the bird. The photoelectric cells were affected by the water vapour, which preceded the bird down the barrel, and the light bulbs were broken before the bird reached them, this may have been due to the air flow past them, but, more likely, they were broken by the pieces of muslin, preceding the bird. They were also found to be short circuiting. The high speed camera proved to be quite good, but was sensitive to changes of light or humidity to such an extent that it sometimes proved impossible to identify the bird, owing to the water vapour, muslin, disintegrating cup, and loose feathers. The other big disadvantage of the camera was that it was so indirect a reading that it took some considerable time to develop and study the film.

The other major problem was finding some sort of cup or plug to place behind the bird to act as an air seal or piston. Initially a cup of Polyurathene foam with a fibre-glass base was used. The cup, however, was so constructed that it disintegrated on leaving the barrel, in order to prevent it doing any damage to the specimen. Because of the light construction necessary to achieve this the cup had to be considerably smaller, in diameter, than the inside of the barrel, in order to prevent it being broken while being loaded. This difference in diameters meant that there was a considerable amount of freedom of movement of the cup, which led to inaccuracies in firing. In order to eliminate these inaccuracies a close fitting plug was made of the same material; this led to a great improvement in accuracy.

The gun itself is of simple design. It consists of a chamber which is pumped up to the required pressure, to give the relevant velocity, a diaphragm, and a barrel, made from a length of commercial steam pipe.

The only major problem in the construction of the gun is the



The 'gun' rigged up for testing cockpit covers.

means of firing. For this purpose a diaphragm is used. The diaphragm itself is made of two layers of terylene cloth impregnated with rubber. The terylene gives the diaphragm its strength and the rubber merely acts as a sealant. A diaphragm of this construction is capable of withstanding a pressure differential of approximately 200 p. s. i., which is well above the normal working differential of about 60 p.s.i., which gives a 4 lb. chicken a muzzle velocity of about 350 m. p. h. Having found a material of suitable strength a breech block, to hold and fire the diaphragm had to be designed. This consisted of a rod held at one end and tensioned at the other, attached to which was a bar which, when the rod was released, moving past top dead centre, thus moving the circular knife, to which it was attached, forwards to cut the diaphragm; thus releasing the pressure in the chamber and firing the chicken.

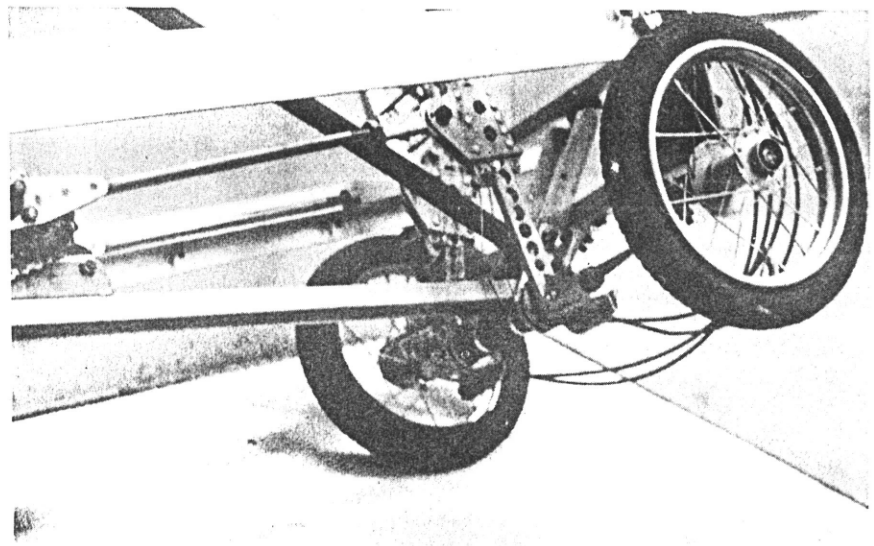
The gun described above is obviously one particular example, but it indicates the problems involved in the design and construction common to all guns for such a test.

PROJECT PTERODACTYL

J.J.L.O.

For the last few years one of the chief attractions of Bristol University's Rag Week has been a 24 hr. race for pedal cars. Up until now, this has been an event restricted to various "back - yard specials" from the Bristol area, but the next race, in March 1966, has been endowed with national status. This will inevitably mean an improvement in the general standard, and the Southampton University Engineering Faculty Society is building a car of very advanced design to challenge for outright victory.

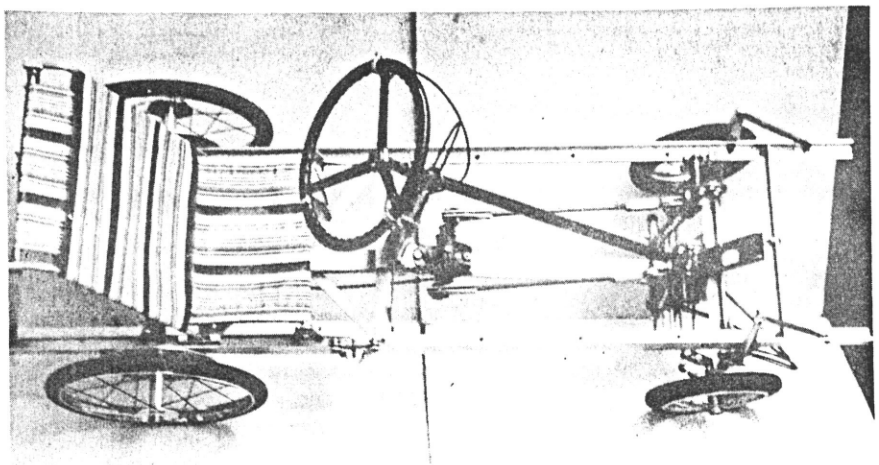
Behind this ambitious project is 2nd year Aero. Engineer Mike Browning, who has spent several weeks designing the "Pterodactyl", as the car is to be called. Mike's confidence in his brain - child is due largely to a secret experimental device to overcome the drawbacks inherent with a one-to-one gear ratio, as specified in the regulations.



It is hoped that the sophisticated design will prove advantageous.

Mike has great hopes of not only winning the race outright, but also of building a competitive team of vehicles to compete in the various classes. There are three divisions altogether, based on wheel size, and the 24 hrs. of frantic pedalling are to be shared by a maximum of six drivers per car; so if a serious effort is to be made to produce a victorious team, at least eighteen volunteer drivers must be found. There is also a category for lady drivers, who have the advantage of being allowed twelve drivers per vehicle.

The cost of producing the first of the projected team of cars has not so far been excessive, owing to the ready availability of raw materials. However, a whole team of such sophisticated machines could prove financially prohibitive. On the other hand, if enthusiasm was sufficient, Mike would like to build a fleet of cheap cars to a straight-forward specification. This will only be possible if enough engineers capable of wielding a hacksaw are willing to put in a few hours work before next March. Anyone who would like to be associated with this project, and that includes drivers, should contact Mike Browning as soon as possible.



Pterodactyl will be fitted with a fully adjustable seat, bodywork and lights for the drivers comfort and convenience.

FACULTY NOTES

Engineering Faculty Society

The Committee for 1965 - 66 are:

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Vice Chairman	P. Walters
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Toastrack Chairman	D. Maltby
Wheel Editor	R. Noblett
Fresher's Rep.	O. J. Whitfield
Quartermaster	P. Foster-Clarke
Kelly's Master	R. M. Kirby

Proposed trips are :-

Frys Chocolates, Bristol

Baddesley Colliery

and Breweries

These should take place in the near future.